

### REMARKS

The Office Action of February 8, 2006, is discussed in detail below.

#### Amendments to the Claims

Applicant has amended claim 1 to eliminate the limitation that the quantum limit atomic aggregations lack a metallic band structure. Claim 1 has also been amended to recite that the quantum limit atomic aggregations have a size of 100 Å or less and to recite that the structure of the quantum limit atomic aggregations is non-crystalline. Support for this amendment can be found, for example, on p. 30, lines 17 – 19 of Applicant's specification ("...the atomic aggregations of the instant materials preferably are metals or metal alloys in the form of particles of 100 Å or less.") and on p. 41, lines 10 – 12 of Applicant's specification ("Upon termination of the reaction, a black powder product was observed. XRD analysis indicated that the product was highly disordered and amorphous-like.")

Applicant has added new claim 20 directed at an embodiment in which the quantum limit atomic aggregations have an amorphous structure. Support for this amendment can be found, for example, on p. 41, lines 10 – 12 of Applicant's specification ("Upon termination of the reaction, a black powder product was observed. XRD analysis indicated that the product was highly disordered and amorphous-like.")

Applicant has added new claim 21 directed at an embodiment in which the quantum limit atomic aggregations are comprised primarily of surface atoms, where the surface atoms are characterized in that they are only partially bonded. Support for this amendment may be found, for example, on p. 22, line 23 – p. 23, line 2 of Applicant's specification ("...the

quantum limit may be viewed as a limiting structural configuration in which atomic aggregations approach or achieve configurations in which most or all atoms are surface atoms.”) and on p. 22, lines 16 – 18 of Applicant’s specification (“Surface atoms are partially unbonded due to the absence of atoms beyond the surface of a material. Surface atoms are accordingly bonded to fewer atoms than interior or bulk atoms of a material and therefore exhibit greater diversity in structure and bonding.”)

Applicant has added new claims 22 – 25 that recite specific embodiments in which the quantum limit atomic aggregations consist essentially of Mg, V, Co or Fe. Support for these amendments may be found on p. 36, lines 13 – 15 of Applicant’s specification (“The product was analyzed with X-ray diffraction (XRD) and found to consist of aggregations of Fe having an average size of 16 – 20 Å.”); on p. 39, lines 9 – 10 of Applicant’s specification (“XRD analysis of the Mg catalyst indicated that it consisted of atomic aggregations of Mg having an average size of 40 nm.”); on p. 41, lines 5 – 6 of Applicant’s specification (“The precipitate was analyzed to be V and XRD and SEM analysis showed that the product consisted of aggregations of V having an average size of 40 Å.”); and on p. 41, lines 8 – 10 of Applicant’s specification (“In this example, the sonochemical preparation of a quantum limit Co catalyst is described. An organometallic Co precursor,  $\text{Co}(\text{CO})_4(\text{NO})$  was used as a starting material. The Co precursor was placed in Decalin in a beaker and sonicated as described in EXAMPLE 1 hereinabove.”).

**Claim Rejections**

**From Paragraph 3 of the Office Action dated February 8, 2006:**

**Claims 1, 4-8, & 11-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stiles (US Pat. 3,317,439).**

Applicant's amended claim 1 recites a quantum limit catalyst having a size of 100 Å or less and a non-crystalline structure. Stiles discloses a catalytic material having an ultimate particle size of no greater than 1500 Å (col. 1, lines 54-63). The catalyst of Stiles, however, is comprised of crystallites (col. 1, lines 60-61 – "The ultimate particles, which are recognizable as crystallites by X-ray techniques..."), where the crystallites have a structure that is crystalline (col. 3, line 12 – col. 4, line 19 (showing a tabulation of catalysts according to Stiles, each of which has a crystal system identified with it); and col. 4, lines 23-27 – "The crystal system indicated above for each of the products shown is the customary and principal form of the compound and in some circumstances various of the materials shown can exist in other crystalline forms or in mixtures of the above with other crystalline forms") The catalytic material of Stiles is therefore a highly ordered material with a conventional periodic structure.

Stiles fails to teach or suggest the non-crystalline structure of Applicant's claimed quantum limit catalyst of amended claim 1 and also fails to teach or suggest the benefits of disorder and lack of rigidity in the structure of a catalytic material that provides the beneficial catalytic and hydrogen storage effects associated with Applicant's invention. Stiles further fails to teach or suggest the amorphous structure of Applicant's catalyst claimed in new claim 20 or a catalytic material that includes primarily surface atoms having the irregular structure associated with the partially unbonded nature of surface atoms as recited in Applicant's new claim 21.

Stiles also fails to teach or suggest the composition limitations recited in Applicant's previously presented claim 19 and new claims 22-25. Stiles (col. 3, lines 70-75) teaches catalytic materials consisting essentially of metals, but the teaching is limited to catalytic materials that consist essentially of a single metal element, where the metal element is Pt, Ni, Cu, Pd, Ru, or Hg. Stiles provides no teaching of catalytic materials consisting essentially of Mg, V, Co or Fe or of catalytic materials consisting essentially of a combination of two or more metal elements.

Since Stiles fails to teach or suggest all of the limitations of Applicant's amended claim 1 and the claims that depend therefrom, Applicant believes that his invention is patentable over Stiles. Applicant respectfully submits that the rejection of claims 1, 4 - 8, and 11 - 19 has been overcome and that these claims, as well as new claims 20 - 25 stand in a condition for allowance. Applicant respectfully requests that this rejection be removed.

**SUMMARY**

The remaining claims in the application are Claims 1, 4 - 8, 11 - 19 and 20 - 25. In view of the present amendment, applicant believes that all remaining claims are allowable over the references cited by the Examiner. Applicant believes that the application, as presently amended, stands in a condition of allowance and respectfully requests withdrawal of all outstanding rejections. If the Examiner has any questions or suggestions regarding this amendment, he is respectfully asked to contact applicant's representative at the telephone number or email address listed below.

Respectfully submitted,



Kevin L. Bray, Ph.D.

Reg. No. 47,439

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Energy Conversion Devices

2956 Waterview Drive

Rochester Hills, MI 48309

Phone: (248) 299-6054

Fax: (248) 844-2273

Email: [kbray@ovonic.com](mailto:kbray@ovonic.com)